

**WHAT IS CLAIMED IS:**

- 1                   1.       A device for delivering a substance to a bone, the device  
2 comprising:
  - 3                   (a)     a bone screw comprising two ends connected by a shaft,  
4 wherein the shaft is cannulated along at least a portion of its length;
  - 5                   (b)     one or more bone-screw fenestrations disposed along the  
6 cannulated portion of the bone-screw shaft;
  - 7                   (c)     an insert disposed inside the cannulated bone-screw shaft,  
8 wherein the insert is cannulated along at least a portion of its length; and
  - 9                   (d)     one or more insert fenestrations disposed along the cannulated  
10 portion of the insert to provide a delivery pathway for the substance between at least  
11 one end of the bone screw and the at least one bone-screw fenestration.
- 1                   2.       The device of claim 1 wherein the insert partially blocks at  
2 least one bone-screw fenestration.
- 1                   3.       The device of claim 1 wherein the insert completely blocks at  
2 least one bone-screw fenestration.
- 1                   4.       The device of claim 1 wherein the cannulated portion of the  
2 bone-screw shaft extends through the entire length of the bone screw.
- 1                   5.       The device of claim 1 wherein the bone screw is a fixation  
2 screw.
- 1                   6.       The device of claim 1 wherein one end of the bone screw is  
2 self-tapping.
- 1                   7.       The device of claim 1 wherein the bone screw comprises a  
2 material selected from the group consisting of titanium and its alloys, tantalum and its

3       alloys, nickel-cadmium and its alloys, steel and its alloys, plastics, absorbable  
4       materials, resorbable materials, polyamino acids, polylactide, polyglycolide,  
5       hydroxylapatite, and tricalciumphosphate.

1               8.       The device of claim 1 wherein the insert comprises a material  
2       selected from the group consisting of titanium and its alloys, tantalum and its alloys,  
3       nickel-cadmium and its alloys, steel and its alloys, plastics, absorbable materials,  
4       resorbable materials, polyamino acids, polylactide, polyglycolide, hydroxylapatite,  
5       and tricalciumphosphate.

1               9.       The device of claim 1 further comprising a substance reservoir  
2       attached to at least one end of the bone screw.

1               10.      The device of claim 9 wherein the reservoir is implanted  
2       subcutaneously.

1               11.      The device of claim 1 further comprising a pump attached to at  
2       least one end of the bone screw.

1               12.      The device of claim 11 wherein the pump is implanted  
2       subcutaneously.

1               13.      A device for delivering a substance to a bone, the device  
2       comprising:

3               (a)     a bone screw comprising two ends connected by a shaft,  
4       wherein the shaft is cannulated along at least a portion of its length;

5               (b)     one or more bone-screw fenestrations disposed along the  
6       cannulated portion of the bone-screw shaft; and

7               (c)     an insert disposed inside the cannulated bone-screw shaft,  
8       wherein the insert is cannulated along at least a portion of its length, and further  
9       wherein the insert is permeable to the substance to be delivered to the bone.

1               14.     The device of claim 13 wherein the insert further comprises at  
2     least one insert fenestration disposed along the cannulated portion of the insert.

1               15.     The device of claim 13 wherein the cannulated portion of the  
2     bone-screw shaft extends through the entire length of the bone screw.

1               16.     The device of claim 13 wherein the bone screw is a fixation  
2     screw.

1               17.     The device of claim 13 wherein one end of the bone screw is  
2     self-tapping.

1               18.     A method of administering a substance to a bone, the method  
2     comprising:

3               (a)     introducing a bone screw into a bone, the bone screw  
4     comprising two ends connected by a shaft, wherein the shaft is cannulated along at  
5     least a portion of its length, and further wherein the bone screw comprises one or  
6     more bone-screw fenestrations disposed along the cannulated portion of the bone-  
7     screw shaft;

8               (b)     introducing an insert into the bone screw, wherein the insert is  
9     cannulated along at least a portion of its length, and further wherein the insert  
10    comprises one or more insert fennestrations along the cannulated portion of the insert;  
11    and

12              (c)     introducing a substance into the cannulated portion of the  
13    insert.

1               19.     The method of claim 18 wherein at least part of the insert is  
2     introduced into the bone screw prior to introducing the bone screw into the bone.

1                   20.     The method of claim 18 wherein at least part of the insert is  
2 introduced into the bone screw after introducing the bone screw into the bone.

1                   21.     The method of claim 18 wherein two or more bones are held in  
2 a fixed position relative to each other by the bone screw.

1                   22.     The method of claim 18 wherein a peripheral skeletal fracture  
2 is mended, an osteotomy is mended, a spondyloysis is repaired, an odontoid fracture  
3 repaired, or lumbar facet joints are fused by the insertion of the bone screw into the  
4 bone.

1                   23.     The method of claim 18 further comprising attaching a  
2 reservoir to at least one end of the bone screw or insert.

1                   24.     The method of claim 18 further comprising attaching a pump to  
2 at least one end of the bone screw or insert.

1                   25.     The method of claim 23 wherein the reservoir is implanted  
2 subcutaneously.

1                   26.     The method of claim 24 wherein the pump is implanted  
2 subcutaneously.

1                   27.     A method of administering a substance to a bone, the method  
2 comprising:

3                   (a)     introducing a bone screw into a bone, the bone screw  
4 comprising two ends connected by a shaft, wherein the shaft is cannulated along at  
5 least a portion of its length, and further wherein the bone screw comprises one or  
6 more bone-screw fenestrations disposed along the cannulated portion of the bone-  
7 screw shaft;

8                             (b)     introducing an insert into the bone screw, wherein the insert is  
9     cannulated along at least a portion of its length, and further wherein the insert is  
10    permeable to the substance to be administered; and

11                           (c)     introducing a substance into the cannulated portion of the  
12    insert.

1                           28.     A method of manufacturing a substance delivery device  
2     comprising :

3                           (a)     producing a bone screw comprising two ends connected by a  
4     shaft, wherein the shaft is cannulated along at least a portion of its length, and further  
5     wherein the bone screw comprises one or more bone-screw fenestrations disposed  
6     along the cannulated portion of the bone-screw shaft; and

7                           (b)     producing an insert that fits in the bone screw, wherein the  
8     insert is cannulated along at least a portion of its length, and further wherein the insert  
9     comprises one or more insert fennestrations along the cannulated portion of the insert.

1                           29.     A method of manufacturing a substance delivery device  
2     comprising :

3                           (a)     producing a bone screw comprising two ends connected by a  
4     shaft, wherein the shaft is cannulated along at least a portion of its length, and further  
5     wherein the bone screw comprises one or more bone-screw fenestrations disposed  
6     along the cannulated portion of the bone-screw shaft; and

7                           (b)     producing an insert that fits in the bone screw, wherein the  
8     insert is cannulated along at least a portion of its length, and further wherein the insert  
9     is permeable to the substance to be delivered.